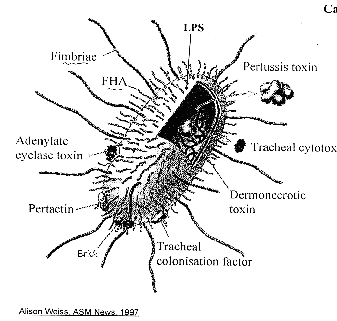
**Pertussis**

Pertussis, better known as whooping cough, is a highly contagious respiratory infection caused by the bacteria *Bordetella pertussis* or *Bordetella parapertussis* [1, 2]. It is most common in the United States and is transmitted from an infected person by way of a sneeze or cough that goes through the air. People of any age and any gender can acquire pertussis; however, before vaccinations became available, it was mainly associated with infants and very young children [2]. After a vaccine became available, the number of cases dropped by about 92% [15]. Presently, more cases are found in adolescents and adults [1]. Although they are rare, fatal cases of pertussis usually occur in infants. Therefore, it is crucial that parents are vaccinated for this disease. Despite the vaccinations for this disease, the vaccine eventually wears off after a while and susceptibility to catching it returns. Pertussis usually lasts for about 6 weeks and includes symptoms of a regular cold, such as a runny nose, sneezing, and nasal congestion. However, after about the first week or two, the symptoms begin to worsen as mucus builds up in the airways causing a severe cough. In infants, these symptoms are worse, making it hard for them to eat, drink, and even breathe [16]. Most cases of Pertussis can be treated by medications, but infants are usually hospitalized because their symptoms are worse and they are at a higher risk for complications. These complications for infants may include ear infections, pneumonia, seizures, and even brain damage [2]. However, about 2 in 100 adolescents and 5 in 100 adults are hospitalized or have complications from pertussis [15]. Getting plenty of rest, drinking plenty of fluids, eating smaller meals, using a vaporizer, and preventing transmission are good remedies to practice while dealing with Pertussis [2].

Pertussis is treated by a drug that targets the protein synthesis of bacteria which is very important for its growth [3]. Without this inhibition, the bacteria would continue to grow and multiply, causing the disease to worsen. The *B. pertussis* species is just one of many types of bacteria in the *Bordetella* genus, but it causes the highest rates of morbidity and mortality in humans among the others. T3SS, or the type III secretion system, allows the bacteria to interfere with the functionality of the host cell. *B. pertussis* produces many toxins and adhesions that contribute to the severe mucus build up consistent with Pertussis. Major adhesion factors include FHA, fimbriae, and Prn. These adhesions remain in contact with the surface of the bacteria to ensure maximal attachment. FHA is a protein about 232 kDa in size, and after cell division, its mature form is bound to the surface of the cell. FHA is also mediated by a two-partner secretion system. A very important part of this secretion pathway involves the removal of one-third of the C-terminus end of the FHA protein. The C-terminus is very significant because it signals the end of the polypeptide and is also involved in DNA transcription and RNA activity. Fimbriae are long and thin and extend from the outer bacterial membrane. Two of its subunits, Fim 2 and Fim 3, contain heparin-binding activity, allowing it to bind to the extracellular matrix of respiratory epithelial cells. This binding connects to the mucus building up in the respiratory tract. Prn is about 93 kDa in size and controls its own secretion across the outer membrane. It contains two proline-rich regions that are implicated in adhesion of the bacteria. The toxins produced by *B. pertussis* include Ptx, ACT, and TCT. Ptx is 117 kDa in size and is transported across the bacterial outer membrane by a secretion system. Its subunits PtxB and PtxC contain factors that are implicated in binding to receptors on the surface of cells. ACT, about 200 kDa in size, is secreted into the environment of the cell by a type I secretion system. A type I secretion system includes other proteins that form a contiguous line that travels between the inner and outer membranes of the bacteria. TCT not a protein toxin, but it is released from *B. pertussis* at high levels and, at 921 Da, it contributes to the bacteria’s adhesion to the respiratory epithelial cells [4].

 Figure : Diagram of *B. pertussis*

Erythromycin is the drug that treats pertussis and fights the *B. pertussis* bacteria from growing and affecting the epithelial cells of the respiratory tract. The drug was first introduced in 1952 by Eli Lilly who’s research team isolated erythromycin from the products of a strain of *Streptomyces erythreus* [5, 6]. Erythromycin’s CAS number is 114-07-8, and its chemical formula is C37H67NO13 [8]. Also, it has a molecular weight of about 734 grams/mole [9]. The drug is a part of the macrolide class of drugs [6]. Antibiotic macrolides are used to treat infections caused by Gram-positive bacteria and infections of places such as the respiratory tract and soft-tissue. Erythromycin can be either bactericidal or bacteriostatic depending upon the individual and the concentration of the drug dispensed. If it is bactericidal, it kills the bacteria to stop it; if it is bacteriostatic, it just inhibits the bacteria from growing. Erythromycin’s mechanism of action is typically to inhibit bacterial protein synthesis, and it accomplishes this by binding to bacterial ribosomal 50S subunits, which is the larger part of the ribosome that serves as the site of mRNA and protein synthesis [7, 14]. This inhibits the activity of peptidyl transferase which is an enzyme that allows for the growth of a protein. Additionally, interference occurs within the translocation that occurs during translation and assembling of proteins [7]. Ultimately, *B. pertussis* is no longer able to grow and increase the severity of Pertussis.

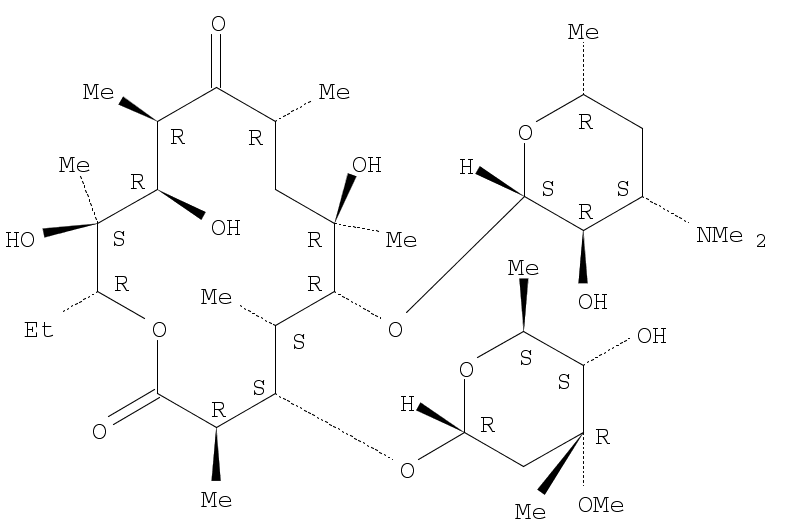


Figure : Schematic Figure of Erythromycin [8]

Erythromycin is orally administered either through a pill or liquid medication [10]. Side effects of this drug include vomiting, loss of appetite, and nausea. Rare, yet serious, side effects include allergy seizures, muscle weakness, loss of hearing, and jaundice [3]. However, taking the medicine with food may help to ease some of these side effects. Some trade names for Erythromycin include Althrocin, Citamycin, E.E.S-400, Elucin, E-mycin, and many others. Other forms of this medication include Azithromycin, Clarithromycin, Clindamycin, Dirithromycin, and Roxithromycin [6]. Its main competitors are Azithromycin and Clarithromycin, which, according to researchers, have improved absorption and an overall better defense against *B. pertussis* than Erythromycin does [12]. This drug is patented and is made by multiple companies, such as Abbott Pharmaceutical, IVAX Corporation, Allscripts Healthcare Solutions, and Pharma Pac. There has been about 150 clinical trials performed dealing with Erythromycin [14]. Erythromycin can be used for other bacterial infections that affect the respiratory tract, skin, and reproductive organs, and it can even be used to treat rheumatic fever [3].

All in all, Pertussis is a very dangerous disease to acquire, especially for infants. It is important to recognize the symptoms and take action immediately, particularly for infants and young children as it can have permanent complications and serious side effects. Erythromycin, and even other similar medications, greatly improve symptoms and allow for a full recovery. However, prevention is the best method, so it is best to get a vaccination for protection against Pertussis, especially for those involved with infants and young children.

**References**

1. Kaneshiro, Neil K. Pertussis. *MedlinePlus* [Online]**2011** http://www.nlm.nih.gov/medlineplus/ ency/article/001561.htm (accessed Feb 3, 2013).
2. Steckelburg, James M.; Harms, Roger W. Whooping Cough. *MayoClinic* [Online] **2012** http:// www.mayoclinic.com/health/whooping-cough/DS00445 (accessed Feb 3, 2013).
3. wiseGEEK. What are the most common uses for Erythromycin Ethylsuccinate? http:// www.wisegeek.com/what-are-the-most-common-uses-for-erythromycin-ethylsuccinate.htm (accessed Feb 3, 2013).
4. de Gouw, D.; Diavatopoulos, D.A.; Bootsma, H.J.; Hermans, P.W.M.; Mooi, F.R., Pertussis: a matter of immune modulation. *FEMS Microbiological Reviews* **2011,** 35, (3), 441-74.
5. Klein, J., History of macrolide use in pediatrics. *The Pediatric Infectious Disease Journal* **1997,** 16, (4), 427-31.
6. New World Encyclopedia. Erythromycin. http://www .newworld encyclopedia.org/ entry/ erythromycin (accessed Feb 3, 2013).
7. Drug Bank. Erythromycin. http://www.drugbank.ca/drugs/DB00199 (accessed Feb 3, 2013).
8. SciFinder. Erythromycin. https://scifinder.cas.org/scifinder/view/scifinder/scifinderExplore.jsf (accessed Feb 3, 2013).
9. PubChem. Erythromycin. http://pubchem.ncbi.nlm.nih.gov/summary/ summary.cgi?cid=12560&loc=ec\_rcs (accessed Feb 3, 2013)
10. Medicines for Children. Erythromycin for bacterial infections. http:// www.medicinesforchildren.org.uk/search-for-a-leaflet/erythromycin-for-bacterial-infections/ (accessed Feb 3, 2013).
11. Tiwari, T.; Murphy, T.V.; Moran, J., Recommended Antimicrobial Agents for the Treatment and Postexposure Prophylaxis of Pertussis. *National Immunization Program, CDC* [Online] **2005**
12. Altunaiji, S.M.; Kukuruzovic, R.H.; Curtis, N.C.; Massie, J., Antibiotics for whooping cough (pertussis) (review). *The Cochrane Library*[Online] **2009**
13. Clinical Trials. Erythromycin. http://www.clinicaltrials.gov/ct2/results?term=erythromycin (accessed Feb 3, 2013).
14. BioChem. The Bacterial Ribosome. http://www.biochem.umd.edu/biochem/kahn/bchm465-01/ribosome/index.html (accessed Feb 3, 2013).
15. Center for Disease Control. Pertussis Vaccination. http:// www.cdc.gov/ vaccines/ pubs/vis/ downloads/vis-td-tdap.pdf (accessed Feb 4, 2013).
16. Center for Disease Control. Pertussis Vaccination. http://www.cdc.gov/ vaccines/pubs/ vis/ downloads/vis-dtap.pdf (accessed Feb 4, 2013).